MEMORANDUM REPORT
CAA-MR-89-3

FIRE MAINTENANCE AND LOGISTICS ANALYSIS (FIRE MAIN)

JULY 1989

PREPARED BY
FORCE SYSTEMS DIRECTORATE

US ARMY CONCEPTS ANALYSIS AGENCY
8120 WOODMONT AVENUE
BETHESDA, MARYLAND 20814-2797

CAA

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Director
US Army Concepts Analysis Agency
ATTN: CSCA-FS
8120 Woodmont Avenue
Bethesda, MD 20814-2797

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SUMMARY

Name of Analysis: Fire Maintenance & Logistics Analysis (FIRE MAIN)

Requester: Director, U.S. Army Concepts Analysis Agency (CAA)

Purpose of Analysis: To provide a short summary of maintenance and logistics data provided in the After Action Review (AAR)[1] of the Yellowstone National Park fire of 1988.

Approach: CAA extensively examined the Department of Defense Joint Task Force (JTF), Yellowstone final report/AAR. CAA analysis addresses two specific areas: (1) helicopter support, and (2) medical support.

CAA Product: This memorandum report provides the analysis and the results of the FIRE MAIN project. The report is organized into three sections: (1) background, (2) approach, and (3) results.

Key Observation: Logistically, forest fire fighting is somewhat similar to combat fighting. The operation & maintenance of helicopters, the medical support system, and casualities generated by fire approximate a combat-like scenario. However, neither the equipment nor the personnel suffered to the extent we would expect in actual combat.

Principal Findings:

(1) The operation of helicopters met Army standards but the Forest Service requirements (e.g., pilot certification, etc.) for flying Forest Service personnel caused underutilization of the helicopters (see Section 3-2.a.).

(2) Disease and nonbattle injury (DNBI) and hospital admission rates are comparable to historical rates, but are higher than the Army training exercise rates and lower than the Wartime Manpower Planning Systems (WARMAPS) rates.

Prepared By: Ms. Kumud Mathur, Force Systems Directorate, U.S. Army Concepts Analysis Agency.

Joint Task Force I

SECTION 1. BACKGROUND

1-1. INTRODUCTION. The involvement of JTF in fighting the Yellowstone National Park fire of 1988 provided a rare opportunity to acquire information about the soldier variables that are necessary to represent combat. During the fire fighting, JTF developed an AAR which recorded logistics, maintenance, and medical data on a daily basis. The Fire Fighting Task Force (FIRE)[2] Study summarized the behavior characteristics during the fire, and suggested an examination of the AAR to determine medical, maintenance, and logistics issues which may have relevance to combat. The data from this actual Army operation will also be available for comparison with training experience, other Army operations, and garrison data. The results can also be used for: (1) future fire fighting planning, and (2) combat simulations.

SECTION 2. APPROACH

2-1. INTRODUCTION. JTF developed an AAR which records information such as type and number of military engaged, type and tasks of helicopters, type of injuries, number of medical evacuations, number of military personnel hospitalized, and the number of military personnel returned to duty every day. The AAR also included a chapter on "Lessons Learned." The information available in the AAR was used to determine key information that should be included in future fire fighting planning.

2-2. OBJECTIVE. Provide factors which should be considered in future fire planning in three main areas: (1) resupply, (2) maintenance, and (3) medical.

2-3. SCOPE. This study analyzes the data which were collected during the Yellowstone National Park fire of the summer of 1988.

2-4. LIMITATIONS. This effort is limited to data provided by the AAR.

2-5. METHODOLOGY

a. Daily accounts of logistics in the AAR were used to develop an ENABLE spreadsheet which includes: (1) helicopter use and maintenance data, (2) medical data, and (3) casualty data. Graphical analysis was performed on the spreadsheet data and percentages were computed to establish relationships among different factors. The time frame for this operation was from 24 August to 23 September 1988. The most fierce fire fighting days were 4 September to 12 September.

b. Factors which affected the soldier performance are summarized from the "Lessons Learned" chapter of the AAR.

2-6. ESSENTIAL ELEMENTS OF ANALYSIS (EEAs)

a. EEA 1. On what mission (task) were the helicopters used the most?

b. EEA 2. What percentage of the helicopters were mission capable?

c. EEA 3. At what strength were the mission capable helicopters utilized?

d. EEA 4. How do casualty rates compare with expected combat casualty rates?

SECTION 3. RESULTS

3-1. RESULTS. The following paragraphs are formulated to answer each EEA.

a. EEA 1. On what mission (task) were the helicopters used the most? Five basic missions were performed by the helicopters: (1) medical evacuation, (2) supply transportation, (3) fire/water bucket support, (4) troop movement, and (5) miscellaneous. Table 3-1 shows the percentages of helicopters used for various missions during the fierce fire fighting days of

4 September to 12 September and for the total operation. On average, for the 4-12 September fierce fire fighting period, 44 percent of the helicopters were used for fire/water bucket operations, 28 percent were used for miscellaneous operations, 16 percent were used for carrying supplies, 10 percent were used for moving troops, and 2 percent were used for medical evacuation. Table 3-1 also compares the distribution of helicopters by mission between the fierce fighting days and the total time of the operation. As expected the largest percentage of the helicopters were used for fire/water bucket operations during both the fierce fire fighting days and the total operation.

Table 3-1. Percentage of Helicopter Use by Mission

Mission	Fierce fire fighting days 4 - 12 Sep	Total time of operation 24 Aug - 23 Sep
Fire/Water bucket	44	35
Miscellaneous	28	18
Supplies	16	23
Troop movement	10	18
Medical evacuation	2	6

b. EEA 2. What percentage of the helicopters were mission capable? Figure 3-1 reflects the percentage of helicopters which were mission capable during the 24 August - 23 September time frame. On the average, 79 percent of the helicopters were fully mission capable and 21 percent were nonmission capable (18 percent were waiting for supply parts, and 3 percent were waiting for maintenance inspections). Army Regulation 700-138, Army Logistics Readiness and Sustainability[5], suggests that the fully mission capable rate of helicopters is 75 percent, nonmission capable for supply rate is 10 percent, and nonmission capable for maintenance rate is 15 percent. The Yellowstone rates are comparable, except the nonmission capable rate for supply parts is higher and nonmission capable rate for maintenance is lower than the Army standards. Averaged together, the overall nonmission capable rate (21 percent) is approximately the same as expected.

c. EEA 3. At what strength were the mission capable helicopters utilized? During the fierce fire fighting days, 50 percent of the mission capable helicopters were utilized. As shown in Figure 3-2, 49 percent of the mission capable helicopters were utilized for the time frame 24 August - 23 September. According to the Army standards, mission capable helicopters are utilized at 75 percent strength. At Yellowstone, the underutilization of helicopters was caused by the Forest Service requirements. The details of the Forest Service requirements are discussed in Section 3-2, Lessons Learned.

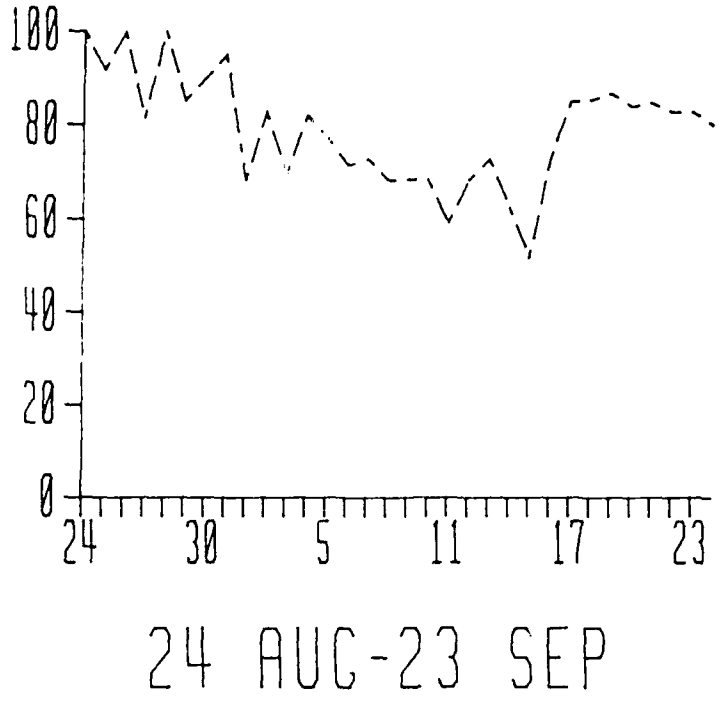

Figure 3-1. Percentage of Mission Capable Helicopters

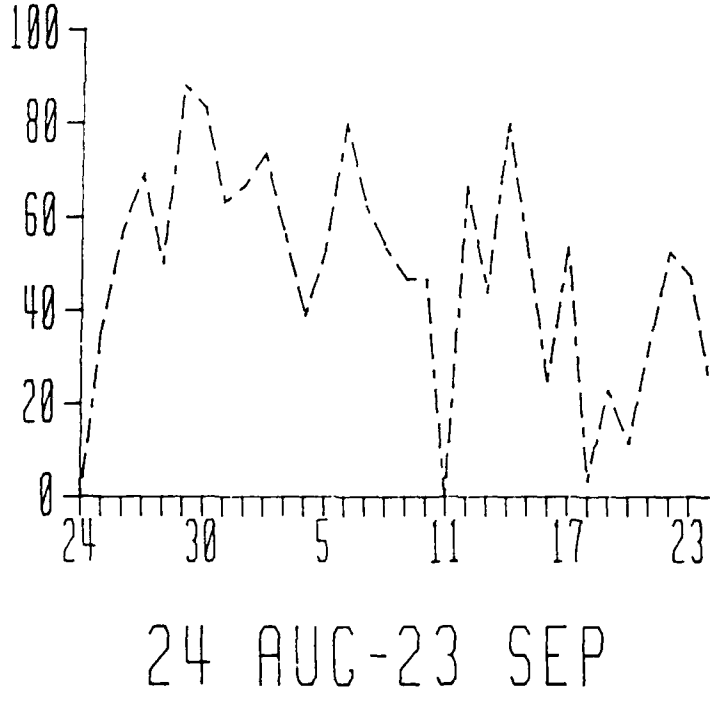

Figure 3-2. Percentage of Mission Capable Helicopters Utilized

d. EEA 4. How do casualty rates compare with expected combat rates? In the forest fire fighting scenario, the enemy analogy is not totally applicable. Fire fighters are faced with a very formidable enemy, but not one of directed malice. Therefore, the wounded in action (WIA), and the killed, captured, and missing in action (KCMIA) types of casualties are not generated. The following two paragraphs discuss the types of injuries incurred and the rates that are generated.

(1) Types of Injuries. Of the types of injuries which occurred during the fire fighting days, heat exhaustion, sore throat, bee sting, and respiratory problems are considered as disease. Joint/back injury, burn, torn chest, and hit by an object are considered as nonbattle injuries (NBIs). Not enough data was available for separate dental analysis, so dental sick calls are included in disease. One soldier killed in a road accident is not considered as killed in action (KIA). Basically, all occurrences of casualties are disease and nonbattle injuries (DNBI). The AAR also has records of hospital admissions. In the next paragraph the DNBI rate and hospital admission rate are compared with historical data and data from military training exercises from the Health Care Studies Division of Academy of Health Sciences, US Army[3].

(2) DNBI and Hospital Admission Rates. The DNBI rate for fierce fire fighting days (4 Sep - 12 Sep) is 31.39/1000/day and the hospital admission rate is 1.32. On the average, for the total operation (24 Aug- 23 Sep), the DNBI rate is 22.32 and hospital admission rate is 1.44. Table 3-2 includes historical rates, the WARMAPS[4] rates, and rates from three training exercises. During the CAX 8-80 exercise from 2 - 16 August 1980, a team from the US Army Research Institute for Environmental Medicine (USARIEM) collected casualty data on 6,010 US Marine personnel involved in a desert training exercise at 29 Palms, California. During Irwin I & II exercises, the Health Care Studies Division, Academy of Health Sciences, US Army collected casualty data on two training exercises of the 40th Division of the California National Guard at Fort Irwin, California, from 3 - 16 May 1981 (Irwin I) and from 24 May - 5 June 1981 (Irwin II). The Yellowstone DNBI rates are much higher than the training exercise DNBI rates. However, the WARMAPS DNBI rates (extrapolated from WARMAPS hospital admission rates) are higher than the Yellowstone rates. The Yellowstone hospital admission rates are close to historical data, higher than the two Irwin exercises, and less than the WARMAPS rates. The CAX 8-80 hospital admission rate is high because 37 percent of sick personnel had to be hospitalized for heat exhaustion. Soldier safety was observed constantly at Yellowstone. Therefore, not many serious injuries occurred during fierce fire fighting days. Hence, the hospital admission rate during the fierce fire fighting days is lower than that of average rate.

Table 3-2. Comparison of DNBI and Hospital Admission Rates

Source	DNBI/1000/Day	DNBI/Hospital admission/ 1000/Day
World War II	NA	1.83
Korea	19.05	1.56
Vietnam	NA	1.20
WARMAPS	43.20**	2.16
CAX 8-80	15.31*	5.69
Irwin I	15.04*	0.24
Irwin II	17.10*	0.26
Yellowstone (4 - 12 Sep)	31.39*	1.32
Yellowstone (24 Aug - 23 Sep)	22.32*	1.44

NA: Not available or not applicable.
* Includes dental.
** Extrapolated.

3-2. LESSONS LEARNED. The AAR chapter, "Lessons Learned" discusses various factors which affected soldier performance while fighting fire. These factors are useful (1) in planning for fighting future fires, and (2) for providing an insight into operation and logistics related problems. The most relevant factors are included in the following section.

a. Certification Problem. According to Forest Service pilot requirements, Army pilots in command (PIC) with 1500 hours total time and 200 hours mountain time were issued authorization cards (carded) to carry Forest Service personnel. Of 29 PICs, only 13 were carded. The uncarded PICs were restricted to fire support and equipment support missions. Secondly, all CH-47 helicopters were required to carry a civilian aircraft load specialist (module). If a module was not available the CH-47 could not perform personnel movement. The result is that the helicopters were underutilized and the soldiers frequently walked long distances because qualified helicopters and pilots were not available.

b. Lack of Orientation. Due to the severity of fires, flight crews were committed without complete orientation on procedures in the area of operations. As a result of this lack of flight crew orientation, several flight violations occurred.

c. **Lack of Maps.** Missions in the greater Yellowstone area required exact navigation to find and to avoid numerous areas. Sufficient quantities of maps of 1:250,000 scale were not available upon deployment. This is a safety issue.

d. **Lack of Retail Items at PX.** Soldiers would have been better served had the PX trailer been stocked with additional socks, throat lozenges, eye drops, and those other items required in greater quantities by fire fighters.

e. **Lack of Automation Support.** Many units were initially deployed in Yellowstone without automation support (i.e., TACCS). The lack of a photocopy facility initially hindered the timely submission of reports and completion of administrative requirements.

f. **Lack of Telephone Lines.** Area command did not have sufficient lines to control the number of incidents that were ongoing. The insufficient number of commercial circuits hindered the flow of communications, about the need for critical resources, from fire teams to higher headquarters.

3-3. **RECOMMENDATIONS.** The next effort like FIRE should consider specific issues discussed in the "Lessons Learned" section for planning purposes.

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(3) U.S. Army Concepts Analysis Agency, Bethesda, MD, Casualty Estimation Study - Part 1 (CES1), Appendix H, CAA Study Report, CAA-SR-81-21, December 1981.

(4) Miller, Stanley, Wartime Manpower Planning Systems FY 90 and FY 94 (WARMAPS 90/94) Study, U.S. Army Concepts Analysis Agency, Bethesda, MD, CAA Study Report, CAA-SR-88-18, July 1988.

(5) AR 700-138, Army Logistics Readiness and Sustainability.